Chapter Seven

Research, Survey, Inventory and Monitoring

Required Element #5: **Proposed plans for monitoring Species of Greatest Conservation Need and their habitats, for monitoring the effectiveness of the conservation actions proposed in (4), and for adapting these conservation actions to respond appropriately to new information or changing conditions.**

Background

The lack of species-specific information on the abundance and distribution of SGCN was one of the greatest challenges faced when initially developing this Plan. In some cases species were added to the list simply because information was outdated or unavailable. This continues to occur today despite much progress being made over the past decade, which is why this 2015 version of the Plan identifies Data Deficient species. Because of the dearth of information for the majority of Iowa species, inventory and monitoring for fish and wildlife species became the top priority for implementation of this Plan.

On the other hand, Iowa is fortunate to have a strong spatial data program. The amount and distribution of potential wildlife habitat is comparatively well known. As we continue to implement this Plan, and have more wildlife data to relate to our spatial datasets, we will become better equipped to identify qualitative differences among habitats and track qualitative changes over time.

Iowa recognizes that monitoring is critical to the determination of the status of species, not only those of greatest conservation need, but also the more common species. By monitoring the effects of conservation actions on wildlife, adaptive management decisions can be made to continue to improve, or to cease to harm wildlife species.

For clarity, *inventory, survey and monitoring* are defined as (Thompson et al. 1998):

- **Inventory -** Process of making an itemized list of species occurring within a given area.
- **Survey -** An incomplete count of individuals, objects, or items within a specified area and time period.
- **Monitoring -** A repeated assessment of some quality, attribute, or task for the purpose of detecting a change in average status within a defined area over time.

Long-term monitoring programs give the best picture of the status of wildlife populations over time. Well-designed short term surveys and inventories can indicate the current status and distribution of

wildlife but are often valid only in the area where they are conducted and may quickly become obsolete if habitat or other critical factors change. In Iowa the rapid change in habitat availability on agricultural lands as USDA farm programs change is a frequent example.

Many research studies too numerous to list have provided information on the presence of individual species or groups of species. Prior to the first version of this Plan, virtually all monitoring programs in Iowa have focused on game species, T & E species, common bird surveys (e.g., Breeding Bird Survey), and evaluations of wildlife restorations. This left a large majority of Iowa's fauna out of long-term monitoring programs, making an assessment of trends very difficult.

Statewide Wildlife Inventory – Iowa's Multiple Species Inventory and Monitoring Program

When this Plan was initially developed in 2005, the Steering Committee and the Monitoring Working Group sub-committee agreed that the first priority for monitoring and research was to inventory Iowa's permanently protected wildlife habitats and a sample of habitat on private lands within the state. In addition, virtually all wildlife specialists involved in developing this Plan agreed that inventories, surveys, and monitoring of SGCN to guide habitat and population conservation actions was an essential component for managing Iowa's wildlife into the future. Therefore, in order to meet these needs, the Multiple Species Inventory and Monitoring Program (MSIM) was established in a partnership between Iowa DNR and Iowa State University (ISU). This program, which was launched in 2006, incorporates permanent sampling sites situated on public (federal, state, and county owned) as well as private lands. The design of this program is based on the US Forest Service's "Multiple Species Inventory and Monitoring Guide" (Manley et al. 2005).

Taxa Which Still Need Initial Inventory Work

Difficulties with development of an effective sampling protocol for terrestrial snails and a comparative lack of experts in identification of individual snail species has remained a hurdle Therefore, the inventory phase for terrestrial snails is not yet completed as of 2015. With the proposed addition of crayfish to the list of SGCN, sampling protocols for crayfish are being developed and tested. If potential additional taxa are added to the list of SGCN through the process outlined in Chapter 3, then survey protocols for those taxa will also need to be developed and tested for integration into the MSIM framework for Iowa.

Multiple Species Inventory and Monitoring Program

There are five specific objectives which the MSIM Program is designed to address. They are outlined below.

Objective 1a: Current Inventory of Wildlife in Iowa

This objective is primarily concerned with estimating the statewide spatial distribution of species. Species occurrence and distribution have been derived from the use of several short-duration, high-intensity searches at a large number of areas scattered widely across the state with locations randomly chosen based on the 19 habitat classifications designated in this Plan. (Now that the initial inventory

phase of the MSIM program has been completed, and given that the habitat classifications were revised in the current version of this Plan, the need for stratification based on habitat class will be revisited.)

The design of the MSIM Program has provided the ability to estimate the spatial distribution and status of many species. The overall protocol determines how widespread or isolated a species is within the state and relates distribution to the condition of habitats. Permanent monitoring plot locations were chosen from protected properties based on a stratified random sampling design using quadrant of the state and habitat classification as the stratifications. For a property to be considered it had to contain at least 101 ha (250 ac) of protected land or water within a contiguous boundary (i.e., smaller state owned areas land with adjoining CRP, WRP, NRCS lands were included in potential locations). This design is based on the US Forest Service's Multiple *Species Inventory and Monitoring Guide* (Manley et al. 2005). This Guide outlines monitoring techniques for vertebrate species on National Forest Land. This design allows collection of both vertebrate wildlife data and also plant species composition and habitat data (Manley et al. 2005).

By stratifying the plot locations based upon habitat classifications, we are able to monitor multiple SGCN associated with each habitat type. With the development and implementation of MSIM, Iowa now has nearly 10 years of data on the distribution and abundance of wildlife species including amphibians, small and meso-mammals, butterflies, odonates, freshwater mussels, reptiles, fish and birds.

Private lands sampling sites are mostly focused on lands with wildlife conservation purposes (such as lands enrolled in conservation easement programs such as the Conservation Reserve Program or Wetlands Reserve Program, or managed by conservation entities such as The Nature Conservancy or the Iowa Natural Heritage Foundation). The IDNR and ISU have joint responsibility for coordinating this statewide survey and monitoring program, with assistance from other partners and land management agencies (USFWS, US Army Corps of Engineers, Iowa National Guard, Iowa County Conservation Boards, Iowa Cooperative Fish and Wildlife Research Unit, non-governmental organizations, etc.)

We have adapted the Forest Service Guide to include protocols for additional taxa included within this Plan. Within each permanent terrestrial sampling plot, several techniques are utilized to collect data on a wide variety of wildlife (Figure 7.1). Briefly, specific procedures include pre-field work analysis of GIS coverages and selection of station (bird point count, trap placements) locations. Field work data collection has used trapping, timed track searching, and remote cameras for mammals; ANABAT detectors and limited trapping for bats; visual encounter surveys, coverboards, and trapping of amphibians and reptiles; point counts for birds; walking transects and timed searching for butterflies; visual encounter surveys for odonates; coverboards for snails; electroshocking and trawling for fish; and quadrat surveys for mussels. In addition, data are collected on weather conditions, vegetative characteristics, aquatic variables, and habitat attributes. This allows us to collect information at the microhabitat scale to draw more specific correlations between species occurrence and habitat characteristics/environmental variables.

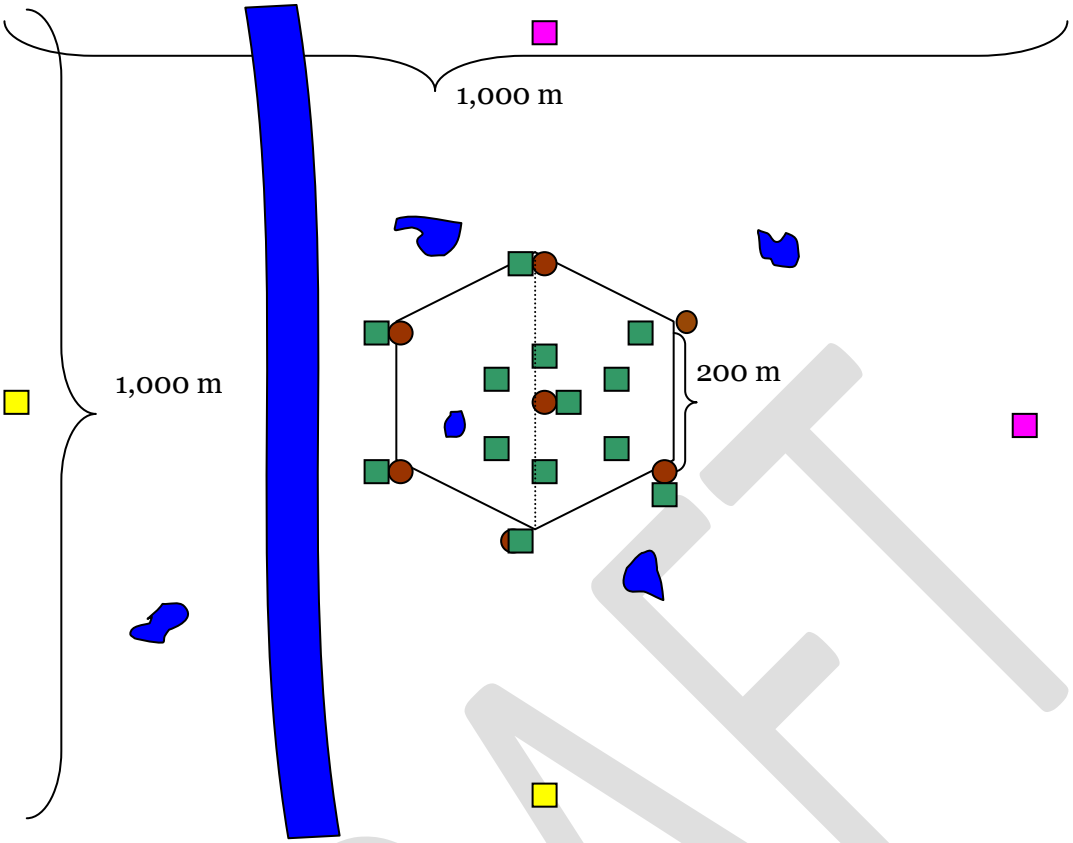

Figure 7-1. Diagram of permanent sampling location. Bird point counts (brown circles) are conducted at each point of the hexagon, including the middle point. Small mammal traps are set along the edge transects as well as the middle transect. These transects are walked for butterflies. Coverboards for herpetofauna are illustrated with green squares. Wetlands (in blue) are searched using time constrained visual encounter surveys for amphibians, dragonflies, and damselflies. Waterbodies are also electroshocked (where applicable) for fish and quadrats are used to search for mussels. Pink squares represent trailmaster camera locations. A camera is also deployed at the site.

Objective 1b: Inventory of Habitat

The above described habitat data collection is done in addition to information currently collected by the IDNR Geographic Information Systems Section which periodically evaluates and compiles landcover classification data (year 2009 is the last complete data set) similar to that recommended by Schoonmaker and Luscombe (2005). This allows the IDNR to track the percentages of habitat types and, over time, changes in these percentages across the state. At this time, we anticipate this evaluation to

be the primary method for monitoring changes in habitats. However, when coupled with the ground-truthing and habitat data collection, which should occur at each of the permanent sampling locations, we can correlate finer scale habitat parameters with broader land cover types. These land cover types serve as the habitat classes for this Plan.

The primary parameter of interest in these designs is the proportion of habitat occupied. Simply knowing species occurrence patterns may not provide sufficient information for managing these species. MacKenzie et al. (2005) suggests that presence and absence data can be used as a surrogate for species abundance as long as the detection probability for the species can be estimated. Estimation of species abundance would require more intense sampling protocols. This design would be expected to generate less information per species because fewer sampling areas and a smaller group of species would be surveyed due to the higher cost per sampling unit. In addition, although providing more in-depth examination of a group of species, the number of taxonomic groups surveyed would be smaller due to the higher costs associated with this more intensive effort.

Objective 2: Monitoring Species and Their Habitats

Now that the initial inventory and survey has been completed, the same sites have begun to be re-visited using the same protocols (unless we discover that these need to be revised). This set of subsequent visits, which began during the field season of 2015, converts the inventory into the monitoring program. Depending on funding, sample sites are visited repeatedly every 2-5 years, with a subset of sites from each habitat being sampled every year to ensure continuity. As with the inventory program, the monitoring program has protocols to examine the plant species composition and the habitats within each sampling site.

The number of sites to be visited per year is dependent upon both funding available and the number of sites needed per habitat class to statistically track changes in species occurrence. A factor in the decision of the number of sites to be visited per year depends upon the percent change (increase or decrease in species occurrence) prudent for determining the status of wildlife populations within Iowa. To detect a smaller percent change, we would need to monitor more sites (Manley et al. 2005).

Data collected within the monitoring program will determine the change in area occupied by a given species (whether sites are being colonized or populations are going extinct) (MacKenzie et al. 2003), the change in the spatial distribution of species, changes in community composition, and changes in habitat. Knowing both changes in habitat and changes in species occurrence allows for inferences to be drawn about correlations between the two. We emphasize, however, that this would be the impetus for future research as opposed to definitive conclusions.

Data collection is conducted by field technicians who are under the direction of ISU and IDNR as paid technicians. All field technicians undergo training that includes species identification and handling techniques, habitat classification techniques, and other training specific to the data being acquired. Data analysis is conducted collaboratively by ISU and IDNR.

Data Management and Archiving

IDNR developed and maintains a database to house data collected through the MSIM program. This database can house information gathered by any entity using the MSIM protocols. The database is secured, but permission to access various reports can be requested. All DNR wildlife biologists have access to records of MSIM species records by property name or county name, for example.

In addition, observations of species tracked by the Natural Areas Inventory program (mostly State and Federally Threatened and Endangered Species) are entered into Iowa's Natural Areas Inventory (NAI) Database, which is used in environmental reviews and other planning processes.

Reporting, Periodic Review, and Evaluation

The monitoring protocol underwent a peer review process prior to implementation. The protocols undergo an internal review every 1 to 2 years and if problems are noticed, advice is sought from outside sources (e.g., university faculty and non-government organization scientists). In addition to the IDNR review, information from the monitoring program is presented at the cooperator's meetings. Results from the monitoring program are reported in regular progress reports, beginning with the "Inventory Assessment" once the initial round of the program was completed and the data was analyzed. At that time any problems encountered with the data collection protocol were addressed and specific directions for research recommendations were suggested. Reports on the project have been made available to the public through the IDNR website. An additional benefit that results from periodic review is the opportunity to evaluate current objectives and establish new objectives and goals of the program in order to adequately meet the changing needs of Iowa's wildlife.

We did expect that some species would likely be missed by the inventory and monitoring programs, but believe that the information gained on a large number of species outweighs this short-coming. We have identified a small number of species that are not being adequately monitored. In some cases, we have solicited proposals to do true research projects with these species (examples include research projects on occurrence of secretive marsh birds, and on Leonard's and Ottoe skippers). In other cases we have collaborated with experts to tweak sampling protocols to allow MSIM to sample these species (e.g., adding tree-mounted traps to capture flying squirrels, adding gopher mound counts to document pocket gopher occurrence). Figure 7.2 illustrates how we implement the decision making process concerning SGCN research and action needs to progress.

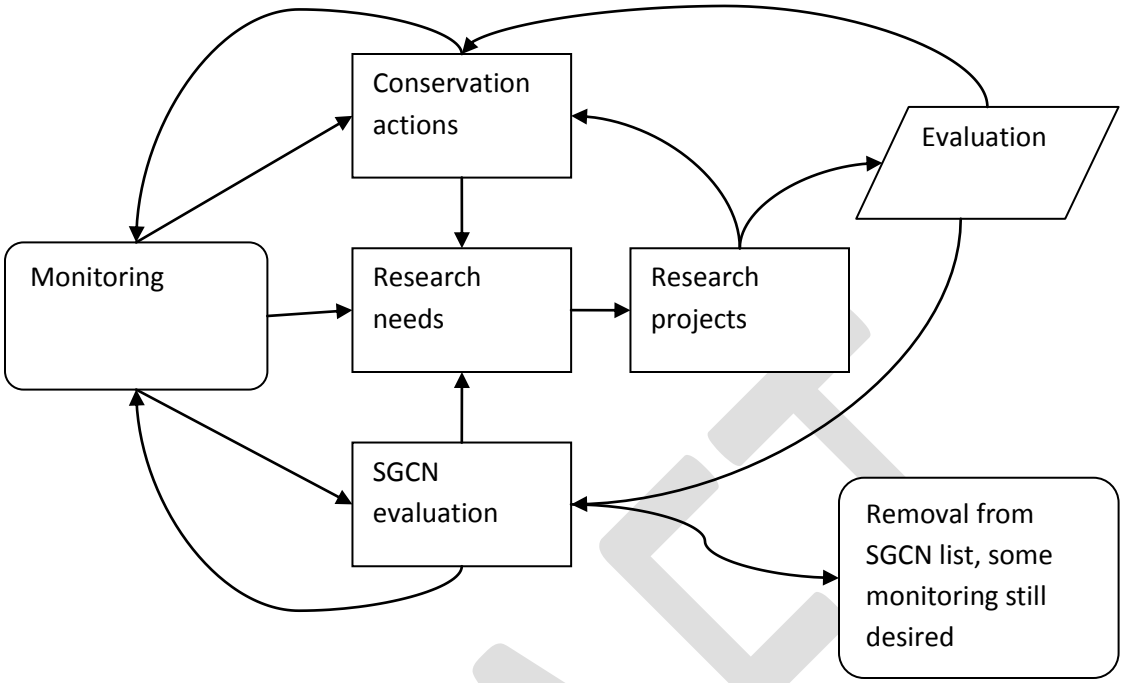

Figure 7-2. Decision making process concerning SGCN.

Additional Benefits

Additional potential objectives of the inventory and monitoring plans which may be able to be addressed through the monitoring data collection include the following (Objectives 3-5):

Objective 3: Strengthening Species Distribution Models

The Gap Analysis Program predicted species occurrences based upon given habitat classification and locations throughout the state of Iowa. Terrestrial GAP models are only available for birds, mammals, amphibians, and reptiles. Aquatic GAP models have been developed for fish. The terrestrial models were created by the use of a combination of range maps and Wildlife Habitat Relationship models, which used 25 ancillary data characteristics (e.g., wetland buffer area, ecotone intersection areas, soil type, highway, elevation) combined with the 29 landcover classes (e.g., eastern red cedar forest, pine forest, evergreen forest, artificial high vegetation, artificial low vegetation, open water [from page 18 of the *Iowa GAP Report*, Kane et al. 2003]) to create predicted areas of occurrence for birds, mammals, amphibians, and reptiles.

In order to develop predictive species distribution models for taxa not included in GAP, or to update predicted distributions based on more recent land cover data, data from the MSIM program can be used. Information from the MSIM program includes geographic locations, species occurrence probabilities, and habitat parameters, which can then be used to build predictive mathematical models. As resources and

funding allow, we will use the predictive mathematical models to create predictive species distribution maps similar to GAP. Developing these maps is time consuming and requires a large amount of computing resources.

These spatial models, based upon landscape variables and microhabitat variables will be beneficial in the implementation of the revision. The maps will be based upon our most recent landcover data layer (from 2009). Using these predictive maps, we should be able to more effectively focus conservation efforts for priority SGCN. These maps would be peer-reviewed by our taxonomic experts and then the public lands within the predicted 'hot spots' for species occurrence will have specific management guidelines developed as well as site specific monitoring recommendations for both habitat and species changes.

This objective could help Iowa further prioritize and set goals for the Action Plan by advancing the utility of the IWAP in a couple of ways. First, the exercise would allow us to produce a density layer of hot spots by overlaying various predictive maps for SGCN which could help inform land protection. Second, individual species maps can be used to assist in focusing management actions suggested from the MSIM data microhabitat models.

Objective 4: Impact and Threat Assessment

The third required element for State Wildlife Action Plans includes, "descriptions of problems which may adversely affect species of greatest conservation need, and priority research and survey efforts needed to identify factors which may assist in restoration and improved conservation of these species and their habitats." Therefore, the impact assessment objective would primarily be concerned with estimating the impact of threats to wildlife and habitats.

A passive approach to this objective would involve recording impacts that may occur within study sites while the monitoring program is on-going and correlating these impacts to changes seen with species population occurrence. It may be prudent to then initiate specific research projects on these areas to examine the result of the impact.

A more research-oriented, experimental sampling design for this objective would be to measure species presence, diversity, and/or populations in areas of 1) habitats lacking the specified threat, 2) areas where steps have been taken to ease/prevent the threat, and 3) areas where the threat is allowed to go forward un-impeded. It may be possible that this can be accomplished within the framework of MSIM, in some cases.

This objective and Objective 5 address the consequences of specific impacts and therefore, will require more intensively designed protocols. Species occurrence alone may not be sufficient to determine the impacts of the threats or of management programs.

Objective 5: Evaluation of Management Protocols and Restoration Programs (*Adaptive Resource Management*)

Regardless of what habitat management protocol is followed (e.g., burning, logging, re-planting, mowing, grazing, or the prevention of any human alterations), different species will be expected to respond in different ways. Within each management unit, it will continue to be important to evaluate the results of management decisions on specified groups of species. For example, long-term research to evaluate the effects of a variety of pasture management regimes (e.g., patch-burn grazing, early-intensive grazing, etc.) is underway on public and private lands in the Grand River Grasslands, a landscape critical for prairie-chickens and other SGCN in southern Iowa. Another project, at the Spring Run Wildlife Management Area, is now in a second phase to evaluate avian SGCN use of restored or recreated prairie and other grassland types in northern Iowa's prairie pothole region. Projects in Northeast Iowa's Driftless Area have evaluated the use of restored areas of open woodlands and goat prairies by birds, reptiles, and butterflies.

In some cases, the same protocols and procedures would be used for this objective as for Objective 4. However, as habitat management impacts result from planned programs, there are sometimes opportunities to design manipulative experiments or more formal applications of adaptive resource management protocols. Ideally, management regimes are outlined, and the assumptions underlying the planned management activities are clearly stated. Then, questions of interest are generated with regards to expected outcomes for target species, and potential impacts of the management on other species that may be of conservation concern. Then, (ideally) data can be collected for several years pre- and post-implementation of the management regime. Again, if species occurrence (or possibly density) was the parameter of interest, it may be possible to address this objective within the MSIM program, however, if more specific questions arise, (e.g., the effect of restoration on survival rates of a given species) then a more intensive sampling regime may be required.

Once the data have been collected and analyzed, decisions regarding the effectiveness of the actions studied can be made. Through this process of adaptive management, we can decide whether the action should be continued to be utilized or not. If it has been determined that the action helped the species targeted by the conservation action, then the action could be implemented elsewhere. Should it be determined that the action did not help the species, then that action would most likely not be implemented on other lands.

Adaptive Resource Management

The inventory and monitoring programs and research projects described in this chapter will support efforts to implement this Plan in an Adaptive Resource Management (ARM) framework (Vision Element #3). Figure 7-3 displays the steps in an ARM framework, which are organized into a loop rather than a sequential list. The loop framework helps conservationists conceptualize the process of management as a learning process that informs future management.

Figure 7-3. Conservation Measures Partnership's *Open Standards* version 3.0 project management cycle.

Long Term Effectiveness Monitoring of Conservation Actions

In addition to biological monitoring, monitoring the effectiveness of conservation strategies described within the Plan is an important component of implementation. Tracking the accomplishments of the IWAP so that political and financial support can be maintained over the 25-year implementation period is a priority of the Plan. A system for tracking accomplishments has been developed by IDNR. In addition, for Plan Implementation projects funded through the Wildlife and Sportfish Restoration Program, Iowa has begun tracking programmatic accomplishments through the USFWS's system, called Tracking and Reporting Actions for the Conservation of Species (TRACS). It is our current understanding that the TRACS system will continue to maintain a public viewer online for stakeholder review and use.

Having information about what has been accomplished is important, but only one component of effectiveness monitoring. A working group formed by The Association of Fish and Wildlife Agencies

developed an Effectiveness Measures Framework, which was designed specifically for effectiveness monitoring of projects funded through the State and Tribal Wildlife Grants (SWG) Program. The Effectiveness Measures Framework serves as a very helpful basis for tracking the effectiveness of all activities undertaken in support of SWAPs. The theoretical basis for the framework lies in the Open Standards for the Practice of Conservation, developed by the Conservation Measures Partnership.

The Effectiveness Measures Framework makes use of *results chains* to display the *theory of change* which links conservation actions through outcomes to ultimate impacts (Figure 7-4). Clearly identifying the theory of change for conservation actions is the key to measuring effectiveness. This is a key component of the Adaptive Resource Management cycle as explained above.

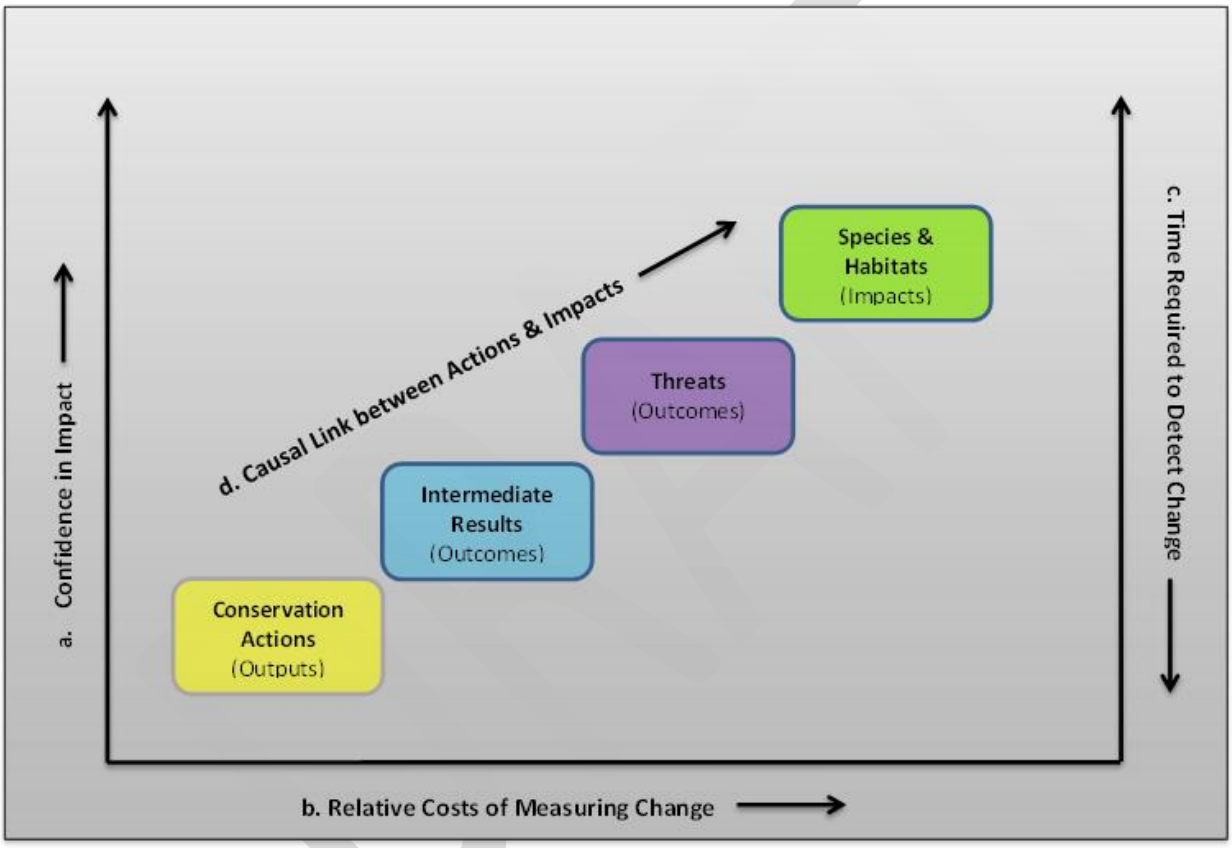

Figure 7-4. Adapted from AFWA (2011) and the 2008 version of the Open Standards for the Practice of Conservation. This diagram illustrates the *theory of change* which links conservation actions to impacts.

The theory of change for overall Wildlife Action Plan effectiveness is displayed in Figure 7-5. The ultimate goal of the Plans is to improve the conservation of wildlife and wildlife habitat. The pathways from development of SWAPs to eventual impacts may rely on certain assumptions (e.g., increased funding). Clearly stating assumptions at the outset makes the process of conservation transparent, and allows stakeholders and decision-makers to understand what will be required for the impact to occur. Identifying points along the path that require evaluation facilitates the process of Adaptive Resource Management.

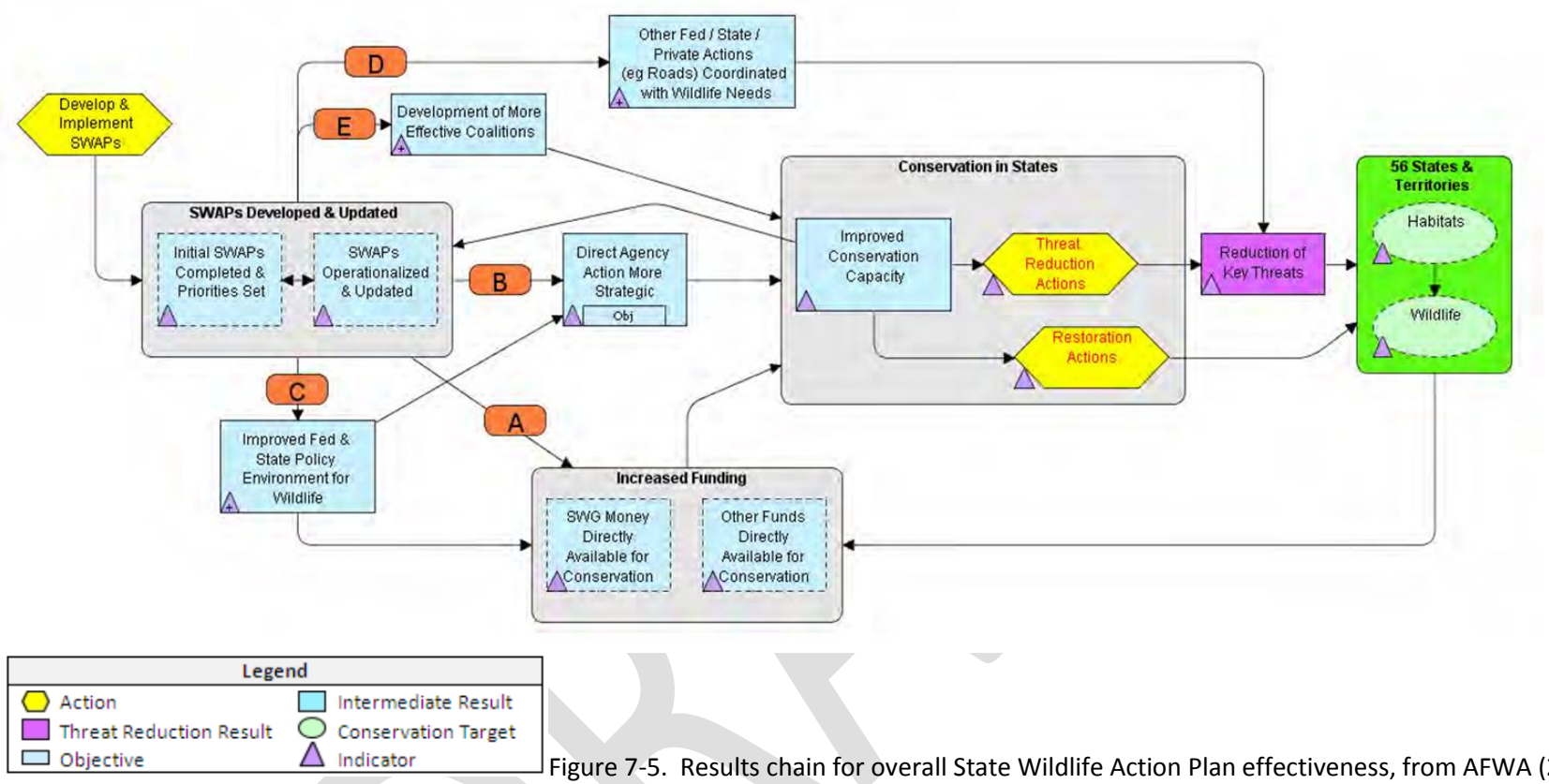

Figure 7-5. Results chain for overall State Wildlife Action Plan effectiveness, from AFWA (2011).

Research Priorities

Statewide distribution and status information is a priority for all SGCN. Additional areas for research continue to be identified as the results of the inventory and monitoring program become available. IDNR and other knowledgeable wildlife researchers regularly work together to identify other priority projects. The initial plan included lists of priority research needs, and progress on addressing these needs has been steady. For this version, the lists of priority research will remain more high-level or strategic to maintain their relevance through the 10-year timeframe of the Plan prior to the next required revision (Table 7-1). More detailed, specific, operational-level lists of research needs will be developed and revised as needed on a shorter, 1-2 year timeframe and posted to the IWAP website. Projects carried out to fulfill research needs on the lists should be rigorously designed from a statistical standpoint, and will require collaboration between researchers and wildlife managers.

Adapting Conservation Actions in Response to New Information or Changing Conditions

Iowa will use new information or changing conditions (e.g., money, politics, environmental catastrophes) to adapt our conservation action. When new threats or actions arise, they will be addressed in a manner that is in accordance with this plan and the approach and steps outlined herein. Periodic meetings of the Implementation Committee and its Working Groups and Subcommittees allow a collaborative approach to addressing changing conditions. At times, an ad-hoc committee may need to be established to work collectively to address a need on behalf of the larger Working Group or Committee.

The ultimate measure of success for the IWAP will be its impact on the wildlife resources of the state. Long term monitoring of all wildlife is necessary to demonstrate the reversal in declining trends of SGCN and to document that common species are remaining common. This can be accomplished only through application of rigorously-designed long term monitoring programs like the Multiple Species Inventory and Monitoring Program that is currently being used to track the status of Iowa's wildlife resources.

A formal review of the IWAP will be conducted every 10 years (see Chapter 9, IWAP Review). This review will include a review of the achievements, the status of wildlife and habitats, assess whether threats have been resolved or have intensified, and to gauge the public's acceptance of the IWAP and its achievements.

Table 7-1. Research Needs for implementation of Iowa's Wildlife Action Plan

Topic	Further Description
Taxa-Specific	**Life history information, occurrence within Iowa, population trends, habitat associations for species**

	- Crayfish, terrestrial snails, dragonflies & damselflies
	  ○ These taxa need more initial survey work to complete an inventory and establish basic distributions of species within Iowa
	  ○ These taxa also need more research to inform population assessment, status, and habitat use of SGCN

	- Data Deficient Species
	  ○ Species listed as Data Deficient in all taxonomic groups need initial survey work to complete an inventory and establish basic distributions of species within Iowa
	  ○ Population assessment, status, and habitat use information for all Data Deficient Species

	- All SGCN ○ Identifying habitat requirements, limiting factors, effective conservation strategies

Topic	Further Description
	- Taxonomic Groups to Potentially Add to IWAP o Basic information is needed for several taxonomic groups of conservation concern (e.g., bees, moths, aquatic snails, etc.) o Within a given taxa, more initial survey work is needed to complete an inventory and establish basic distributions of species within Iowa
Issue-Specific	**Effects of the following items on species occurrence, density, or reproductive success or other demographic factors**
	- Habitat Management o Methods or techniques o Management regimes (i.e., timing, duration, or frequency)
	- Habitat Restoration or New Habitat Projects o Pre-and-post effects of restoration o Feasibility assessments for species re-introductions or re-locations
	- Landscape Ecology o Evaluating connectivity between core habitat areas o Evaluating landscape permeability o Quantifying ecosystem functioning
	- Land Use o Renewable energy development o Farming practices o Effects of urbanization on species
	- Climate Change
	- Invasive species
	- Farm Bill Programs
	- Wildlife diseases
	- Environmental contaminants
Area-Specific	**Research or monitoring projects which rely on spatial datasets**
	- Identifying critical habitat components o Landscape factors affecting species of greatest conservation need (structural features, landscape configurations, and amounts of habitat)

Topic	Further Description

	- GIS and landscape modeling
	  o Continued development of the Bird Conservation Area and Amphibian and Reptile Conservation Area models to identify geographic focus areas for habitat protection, restoration, and management
	  o Continued predicted species distribution map development
	  o Assessments of land use and/or land cover change
	  o Monitoring amount, location, and quality of habitat

Human Dimensions	**Sociological research relating to wildlife and wildlife habitat**
	- Sociological research to evaluate Iowan's values, behaviors, or attitudes with regards to wildlife conservation programs - Studies to enhance understanding of patterns of participation in wildlife-associated recreation (e.g., barriers or opportunities to overcome barriers to participation) - Development and improvement of methods for stakeholder engagement

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